Submitted herewith are the following documents as required by the Office Action:

(1) Supplemental Reissue Declaration;

(2) Assent of Assignee to Reissue;

(3) Statement under 37 CFR 3.73(b); and

(4) Declaration as to Inaccessibility of Original Letters Patent.

Claim 43 has been amended to recite a photo detecting means.

In light of the foregoing, it is submitted that this application is in condition for allowance, and a notice to that effect is respectfully solicited.

If any issues remain which may best be resolved through a telephone interview, the examiner is requested to telephone the undersigned at the local Washington, D.C. telephone number listed below.

Respectfully submitted,

Date: April 9, 2001

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Exhibit I-marked up version of the amended claim

43. (Amended) An optical recording/reproducing system comprising:

(a) an optical recording/reproducing apparatus for recording, reproducing or erasing an information signal onto/from any one of N types (where N ≥ 2) of optical discs having first layers of different thicknesses, each type of said optical discs having at least said first layer being transparent and a second layer for storing information, said apparatus comprising:

a light emitting means for emitting said light flux; [and]

a converging optical system including a first converging means and a second converging means, said converging optical system for converging, by employing one of said first converging means and said second converging means, a light flux on said second layer of one of said N types of optical discs and for performing aberration correction at said light flux[,]; and

photo detecting means for detecting reflective light from said optical discs;

wherein when the first layer of a first disc of said N optical discs has a thickness (d1) smaller than a thickness (d2)of the first layer of a second disc of said N optical discs, said one of said first converging means and said second converging means, which is employed by said converging optical

system, converges the light flux to a spot on the second layer of said first disc with a diameter (D1) smaller than a diameter (D2) of a light spot converged by the other of said first converging means and said second converging means, which is employed by said converging optical means, on the second layer of said second disc, and

wherein a thickness of said first layers of each of said N types of optical discs is about 1.2mm or less,

(b) a signal processing means, responsive to one of (i) a reproduction signal, corresponding to said information signal, from said photo detecting means and (ii) receipt of recording data, corresponding to said information signal, for recording on said disk, for generating an output signal corresponding to said information signal and for performing one of a reproducing operation and a recording operation on said discs; and

(c) a system controlling means coupled to said signal processing means for controlling generation of the output signal of said signal processing means.

OPTICAL RECORDING/REPRODUCING APPARATUS FOR OPTICAL DISKS WITH VARIOUS DISK SUBSTRATE THICKNESSES

This is a reissue continuation application of reissue application no. 08/396,981 which issued as RE 36,445 on December 14, 1999, which was a reissue of United States Patent No. 5,235,581 issued August 10, 1993. The following are related continuation reissue applications: application no. 09/420,603 filed October 19, 1999, application no. 09/609,699 filed November 22, 1999, application no. 09/609,829 filed November 22, 1999, application no. 09/460,222 filed December 13, 1999, and application no. 09/460,223 filed December 13, 1999.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to an optical disc apparatus which can record, reproduce, or erase information signals onto/from both of an optical disc having a recording density similar to that of a conventional CD (compact disc) and an optical disc having a recording density higher than the above recording density.

2. Description of the Prior Art

In recent years, in addition to an optical disc apparatus only for reproduction such as a CD player or the like, an optical disc apparatus which can record and reproduce an information signal is actively being developed.

Ordinarily, the recording and reproduction of an information signal onto/from an optical disc are executed by converging a beam which is radiated from a semiconductor laser or the like onto a recording layer of the optical disc by a lens. The recording layer here denotes a pit layer in the case of a CD and is a layer in which a deformation, a change in optical constant, a formation of a magnetic domain, or the like is performed by a converged laser beam in the case of a recordable optical disc. To raise a recording density of the optical disc, it is necessary to reduce a spot diameter D of the converged beam. There is the following relation among the spot diameter D, a numerical aperture NA of the lens, and a wavelength λ of the laser beam.

$$D \propto \frac{\lambda}{NA} \tag{1}$$

The above equation (1) denotes that the beam spot diameter D decreases by using a lens of a large NA. That is, by increasing NA, the high density recording can be executed.

When NA of the lens increases, however, an aberration of the converged beam due to an inclination error of the disc called a tilt increases. Particularly, a coma aberration increases. There is the following relation among a wave front aberration W_c of the coma, a tilt angle α, and NA when using a thickness d and a refractive index n of the disc substrate.

$$W_c \propto \frac{n^2 - 1}{2n^3} \cdot d \cdot \alpha \cdot (NA)^3 \tag{2}$$

The above equation (2) denotes that in the case of using a lens of NA which is larger than that of the conventional lens, even if a tilt angle is identical, the coma aberration increases. It will be understood from the equation (2), however, that there is an effect to suppress the coma aberration by setting the thickness d of the disc substrate to be thin. In the optical disc for the high density recording, therefore, it is preferable that the thickness of the disk substrate is thinner than that of the conventional optical disc, so that an optical head using an objective lens corresponding to the thin disc substrate is needed.

On the other hand, even in the optical disc apparatus corresponding to the high density recording, it is preferable that the conventional optical disc of a thick sub-